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MONTHLY REPORT - DECEMBER 1983

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SOUTHWEST FISHERIES CENTER
LA JOLLA, CALIFORNIA

HONOLULU LABORATORY
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TIBURON LABORATORY
PACIFIC ENVIRONMENTAL GROUP

MONTHLY REPORT - DECEMBER 1983

STATUS OF PUBLICATIONS

Approved by Center Director

Alcorn, Doris J., and Alan K.H. Kam. First record of a fatal shark attack on a Hawaiian monk seal. J. Mammal. (Note).

Barss, William H., and Tina Echeverria. Maturity of widow rockfish (Sebastes entomelas) from the northeastern Pacific, 1977-1981. For publication in the Proceedings of the Widow Rockfish Workshop.

Fiedler, Paul C. Satellite observations of El Niño along the U.S. Pacific coast. For consideration for publication in Science.

Kawaguchi, K. and H.G. Moser. Ontogeny and systematics of fishes Stomiatoidea (I). For publication in the Ahlstrom Symposium Series.

Uchida, Richard N., and Darryl T. Tagami. Fishery for groundfish over seamounts in the North Pacific Ocean. Mar. Fish. Rev.

Walker, Michael M. Learned magnetic field discrimination in yellowfin tuna, Thunnus albacares. J. Comp. Physiol., A.

Administrative Reports

[U.S.] National Marine Fisheries Service. Annual and average monthly trends in catch of large pelagic species in Hawaii, 1948-78. SWFC Admin. Rep. H-83-24.

THIS REPORT DOES NOT CONSTITUTE PUBLICATION AND IS FOR INFORMATION ONLY.

Honda, Victor A. 1983. Annotated bibliography of selected published and unpublished works on billfish, mahimahi, wahoo, and sharks. SWFC Admin. Rep. H-83-27.

HONOLULU LABORATORY

INSULAR RESOURCES INVESTIGATION

Announcement and Agenda for Seamount Workshop Prepared

Richard N. Uchida, Leader, Insular Ecosystem Program, reports that the announcement and agenda for the "Informal Workshop on the Environment and Resources of Seamounts in the North Pacific" were prepared, and pending approval from the Far Seas Fisheries Research Laboratory in Shimizu, Japan, and the Japanese Society of Fisheries Oceanography, Tokyo, Japan, will be mailed to participants before the date of the workshop in March.

* * * * * * * * * *

Richard Uchida and research assistant Michael P. Seki traveled to Beaufort, North Carolina this month to meet with Drs. Edward P. Myers, Head, Ocean Thermal Energy Conversion (OTEC)/Assessment Division of the Office of Ocean Minerals and Energy, Washington, DC, and Donald Hoss and David Peters of the staff of the Beaufort Laboratory, Southeast Fisheries Center, for the purpose of completing the draft final report on potential impact of OTEC plant operations on fisheries.

* * * * * * * * * *

Richard Uchida continued editing sections of the Fishery Atlas of the Northwestern Hawaiian Islands contributed by various investigators. Also, Uchida, Reginald M. Gooding, James H. Uchiyama, and Thomas S. Hida, Fishery Biologists, completed reviews on eight FY 1984 fishery project proposals for Saltonstall-Kennedy funding at the request of the Hawaii Fisheries Coordinating Council.

LA JOLLA LABORATORY

Coastal Fisheries Resources Division

COASTAL EASTERN PACIFIC POPULATION BIOLOGY OF FISHES

Pacific Sardine Induced to Spawn in the Laboratory

Roderick Leong, Fishery Biologist, reports that he was successful in spawning the Pacific sardine in the laboratory in December. The fish have been maintained since August in an outside, 24 ft. swimming pool at ambient water temperatures. In August the ovaries of all fish were inactive with the largest oocytes about 0.15 mm. As of this writing, January 1984, the oocytes in the ovaries of some of the females have reached 0.6 mm which is the size at which hydration can occur.

Maturation began after November, when the ambient temperature began to decline from 20°C in November to 16°C in January. Some of the mature fish were given two injections, the first, 1,000 iμ of human chorionic gonadatropin and the second, 24 hour later, 20 mg salmon pituitary. The fish spawned naturally 16 hour after the second injection. Examination of the larvae after the eggs hatched indicated that the spawn was viable.

Future work will involve defining the conditions for maturation in the laboratory, improving the hormone treatment for induction of final maturation and hydration, and in general, establishing a reliable protocol for induction of spawning in the California sardine. Four projects which can be undertaken once routine spawning in the sardine is established are: 1) calibration of daily increments on the otoliths of sardine larvae, 2) development of routine culture methods for sardine larvae, 3) age calibration of the post-ovulatory follicles of adult female sardine, and 4) determining threshold number of food particles needed to induce first-feeding in sardine larvae.

Three Manuscripts Completed for Manual on Egg Production Method of Biomass Estimation

John Hunter, Fishery Biologist, reports that several manuscripts were completed by the January 1 deadline for the manual on egg production. These manuscripts were as follows: Batch fecundity, by J. Roe Hunter, Nancy Lo and Roderick Leong (41 pp); Formalin preservation of northern anchovy by John Hunter (9 pp), and Estimation of spawning frequency by J. Roe Hunter and Beverly Macewicz (39 pp).

The manuscript on batch fecundity describes the hyrated oocyte method for estimating batch fecundity, and reviews past methods, including an original

statistical analysis by Lo on the precision and accuracy of batch fecundity estimation. In addition it provides a covariance analysis of all fecundity estimates on northern anchovy which indicates that batch fecundity has varied significantly over the past 6 years.

The manuscript on fish preservation describes present preservation techniques and provides new data and coefficients for the effect of formalin preservation over time on adult anchovy length and weight.

The third manuscript on estimation of spawning frequency, provides histological descriptions of the oocytes, postovulatory follicles, and of atretic oocyte stages and atriatic states of northern anchovy. It also reviews other methods of estimation of spawning frequency in addition to the post-ovulatory method which is used in anchovy biomass estimation. A final section discusses the differences between seasonally indeterminant and determinant fecundity, and suggests approaches on how to document whether or not fecundity is indeterminant. In fishes with indeterminant fecundity, batch fecundity is the only useful fecundity estimate, whereas in fishes with seasonally determinant fecundity the standing stock of yolked eggs is believed to represent the total number of eggs spawned in a season. Whether or not fecundity is determinant or indeterminant is a critical issue for biomass estimation using ichthyoplankton.

Manuscripts Completed on Culture Methods and Larval Predation

John R. Hunter, Fishery Biologist, reports that the final drafts (after review) of two manuscripts were returned to the editor this month, meeting December deadlines. These were: "Synopsis of culture methods for marine fish larvae", by J.R. Hunter (26 pp) for the Ahlstrom Memorial Symposium volume and "Inferences regarding predation on the early life stages of cod and other fishes" by J.R. Hunter (32 camera-ready pages) for a symposium on the Propagation of Cod, Gadus morhua. The first manuscript is a condensed practical guide and key to the literature for scientists interested in small-scale laboratory culture of marine fish larvae. The second paper is a review and synthesis of the literature on the predation on eggs and larvae of marine fishes and includes a discussion of preferred directions for future research on larval predation.

COMMERCIAL AND RECREATIONAL FISHERIES RESEARCH FOR MANAGEMENT

Fishery Biologist Alec MacCall Receives Doctor of Philosophy Degree from UCSD

Dr. Alec MacCall, Fishery Biologist, received a Ph.D. from UCSD-SIO on December 10 based on his dissertation titled, "Population models of habitat selection, with application to the northern anchovy." The abstract of his thesis follows:

"Habitat suitability is defined as the marginal component of reproductive value conferred by a habitat. Realized habitat suitability includes the effects of population density already occupying that habitat. By treating habitat suitability as a continuous spatial variable, the principles of density dependent habitat selection can be extended to the population level. The geographic distribution of habitat suitability at zero density is described by a topographic map; if suitability is depicted as increasing downwards, this topography takes the form of a basin, with the most suitable (deepest) habitat near the center, and poorer (shallower) habitat toward the periphery. The population is depicted as a liquid filling this basin: the volume of liquid relates to the population size, the depth relates to the density dependent decrease in suitability, the surface corresponds to the realized suitability (and trends to be level, corresponding to an ideal free distribution), the surface area corresponds to the range, and changes with population size. Population moves viscously in response to gradients in realized suitability. When suitability is equated to per capita growth rate, the model generates populaton growth and geographic movement dynamics simultaneously. Because of habitat selection, population growth curves are skewed relative to local habitat growth curves, being more productive at lower fractions of carrying capacity. Optimal harvesting from a viscous population requires most intense removals from areas of highest abundance.

This basin model is implemented for the spawning distribution of the northern anchovy (Engraulis mordax). Suitability is assumed to be measured by log survival of offspring, which declines linearly with adult abundance due to cannibalism. Estimates of local egg mortality rates are affected by transport, but corrected estimates indicate the approximate geographic uniformity of the ideal free distribution. Using larval abundance to indicate spawning distribution, the suitability topography is estimated by maximum likelihood. Inshore southern California waters are the most suitable spawning habitat, inshore northern Baja California and far offshore are intermediate, and central California and far offshore are poorest, but are occupied at carrying capacity. Environmental factors associated with this topography appear to be related to upwelling and unfavorable transport."

Trawl Fleet Data Summarized from PACFIN Research Data Base

Following the completion of an annual summary file for all Pacific Coast commercial fishing vessels in 1981 by Susan Iacometti, Computer Systems Programmer, economist Dan Huppert has constructed a trawl fleet summary using a list of trawl vessels obtained from State agencies by C. Korson, Economist at SWR, the annual PACFIN summary landings file, and the PACFIN fishing vessel characteristics file. The resulting data file contains information on annual harvest in 35 species groups, total exvessel revenue, vessel characteristics (length, gross tonnage, year built, gear types used), and areas fished during the year. In addition, principal gear, port and species groups, were defined for each vessel based upon which gear, port and species accounts for the largest fraction of total revenue received.

Preliminary descriptive statistical analysis shows that of the 409 vessels identified as trawlers by the States, 395 appear in the 1981 PACFIN

data base. The primary gear used by 353 of the vessels is trawl gear (bottomfish trawl, midwater trawl, shrimp trawl); the most common primary species groups are rockfish, Dover sole, other sole and pink shrimp; and the most common primary ports are Newport, Coos Bay and Astoria, Oregon, and Crescent City and Eureka, California. Based upon principal port, vessels are distributed among States as follows: Washington - 77, Oregon - 156, California - 149. Estimated gross revenue per vessel has a skewed distribution with 52% of the vessels getting less than $100,000, 27.3% getting between $100 and $200 thousand, 12.7% between $200 and $300 thousand, 5.3% between $300 and $400 thousand, and 2.5% over $400 thousand.

One reason for establishing a fishery data base for the three-state area is to facilitate comprehensive accounting for all vessels in a fishery. In the past researchers have often asked each individual state to indicate the number of vessels fishing in a specific fishery like the trawl fishery. To avoid double-counting vessels that fish in more than one state one must be able to identify each vessel fishing in each state by some unique ID code. The construction of the PACFIN research data base does exactly this. For the 395 trawl vessels in 1981, fishing activity by state is summarized in the following table in which the diagonal elements indicate the number of vessels active in only one state and the off-diagonal elements indicate the number of vessels fishing in the pair of states corresponding to the row and column labels.

	California	Oregon	Washington
California	128	45	11
Oregon		100	35
Washington			64

*Also, 12 vessels landed fish in all three states.

Thus, for example, 128 vessels fished solely in California, and an additional 68 (45 Oregon, 11 Washington, and 12 three-state vessels) fished in California and at least one other state. The sum of the number of trawlers reported for each individual state separately is 510--a 29% overstatement of the number of trawlers on the Pacific Coast. The prevalence of this inter-state activity will vary across fisheries, with a much higher level expected in the albacore and salmon troll fisheries.

These descriptive statistics for the trawl fleet are being used to validate the data base, and they will help to direct future research regarding bottomfish trawling. This is a prototype effort which will facilitate the more difficult tasks of providing annual status reports and predictive economic models for several key Pacific Coast fishing fleets.

SWFC/SWR Economists Meeting Held at Tiburon Laboratory

Economists from La Jolla, Honolulu, Terminal Island and Tiburon met at the Tiburon Laboratory December 7-9 to discuss current research efforts and to begin planning for Pacific Coast groundfish economic research. Due to the importance of the latter topic in the Pacific Northwest, the SWFC/SWR economists were joined by Richard Marasco and Joseph Terry of the Northeast and Alaska Fisheries Center (NWAFC). As a first step in groundfish planning, Dr. Dan Huppert led the group through a Nominal Group Technique (NGT) focusing on the "triggering question": What should be the main components of a Pacific Coast groundfish economics research program?

The highest-priority research components were found to be:

(1) Investigate strategies for managing fisheries in the face of great uncertainty about biological and economic systems.

(2) Define analytical, operational and management units.

(3) Develop predictive models of switching behavior among groundfish and alternative fisheries (e.g., crab, shrimp).

(4) Develop models capable of estimating net economic impact of regulatory changes, stock condition, etc.

(5) Develop generic costs and benefits to be considered in determining optimum level of aggregation of species and areas in management units.

In all, 52 ideas were generated for groundfish research, some being associated with data needs, some with program needs (manpower and budget), and many being associated with specific management-oriented research projects. Huppert will be refining the research plan with a Delphi-like interactive technique.

Stage-to-Age Procedure for Anchovy Eggs Automated

The egg production method is used to estimate the annual spawning biomass of northern anchovy. Each year, all the eggs sampled are first staged according to their embryonic development. Proper ages are then assigned to eggs according to a family of temperature specific developmental curves and the time and temperature of the tow. This stage-to-age procedure has always been processed manually. Now, Dr. Nancy Lo has developed an automated procedure which permits the computer to do the ageing. The key point of the automation procedure is construction of a look-up table which contains the estimated ages of eggs for each of the 11 stages at temperatures ranging from 10-22°C, sampled at any time throughout a 24-hour period. The 1980-83 egg data were used to compare the manual and automated procedures. According to Dr. Lo the initial results are encouraging (Table 1), and the automated system is scheduled to be implemented this year.

Table 1. Number of eggs per ton grouped by day, A (4-27 h), B (28-51 h), C (52-75 h), D (76-99 h) from the manual system (m) and the proposed automation system (A) for each year in 1980-83, and four years combined.

		A	B	C	D	Number of tons[1]
1980	m	13.65	8.86	4.91	0.16	312
	a	13.74	9.78	4.08	0.03	
1981	m	12.32	10.33	6.91	0.47	564
	a	13.86	12.00	4.98	0.13	
1982	m	9.00	7.00	4.44	0.31	308
	a	10.55	7.66	4.02	0.16	
1983	m	9.16	8.42	2.88	0.002	482
	a	8.90	8.47	2.61		
1980-1983	m	11.04	8.89	4.9	0.24	1666
	a	11.96	9.79	4.15	0.07	

[1]Positive tons only.

The advantages of this automated system are twofold; 1) it saves time; the current manual system requires one week of manpower to age the eggs, enter the data, and build the data files for the estimation of egg daily mortality and egg production. The automated system requires at most a half-day to process the staged eggs and produce egg daily mortality curve, and 2) standardizes the method: the automated system eliminates the subjectivity of human judgment and variation resulting from operator errors. Thus, the accuracy of the egg production and the egg mortality estimate will be improved.

Oceanic Fisheries Resources Division

TUNA AND BILLFISH RESOURCES PROGRAM

Status of Atlantic Tuna Fishery Sampling Program

Foreign-caught Atlantic tunas transshipped to Puerto Rico are sampled routinely for biological information by biological technician Eugene Holzapfel. Data on fork length, weight, and species composition of catches are collected. Results of Holzapfel's sampling during the period January 1, 1983 to December 31, 1983 are as follows:

Species and gear	# of samples	# of fish sampled	Tonnage sampled (MT)
Yellowfin			
Purse seine	16	1068	523.0
Baitboat	25	1949	371.2
Longline	1	71	1.1
Unknown	14	1071	188.7
Skipjack			
Purse seine	8	406	2055.2
Baitboat	15	755	1533.7
Unknown	2	101	117.0
Bigeye			
Purse seine	12	402	278.4
Baitboat	2	69	1.0
Unknown	6	162	47.9
Albacore			
Longline	2	100	1262.6
Unknown	3	150	938.2
Blackfin			
Baitboat	2	100	13.3
Bullet tuna			
Purse seine	1	50	180.3

During the period of January 1 to December 31, 1983, 26 size composition samples were collected for the Multi-species Data Management and Fisheries

Monitoring Program by the Inter-American Tropical Tuna Commission. These data were collected from seven foreign purse seiners that fished in the Caribbean Sea and transshipped their catches to Puerto Rico. A summary of these data follows:

Species	Trips sampled	# of samples	# of fish sampled
Yellowfin	7	10	500
Skipjack	7	9	452
Blackfin	4	4	119
Bigeye	2	2	6
Albacore	1	1	18

1983 Cumulative U.S. Tuna Receipts Tallied

According to industry economist Sam Herrick, landings data compiled by the Market News Service of the National Marine Fisheries Service's Southwest Region, indicate that overall U.S. cannery receipts of albacore, bigeye, skipjack and yellowfin tuna through May 31, 1983 are down 7% compared to the same period during 1982. Cumulative 1983 albacore and yellowfin tuna receipts (imports plus domestically-caught fish) have declined 38% and 25% respectively from 1982, while bigeye tuna receipts have increased 100%, and skipjack tuna receipts are up to 20% from 1982. Reported quantities of imports and domestically-caught tuna received at major U.S. landings sites through October 31, 1982 and 1983 are presented in the accompanying table (note that continental sites include bigeye and albacore):

Species	Site	Source	Quantity # 1982 (S.tons)	Quantity # 1983 (S. tons)	Per. chg. 1982-83
ALB	PR	I	50,186	39,792	- 20
ALB	PR	D	0	4	100
ALB	AH	I	21,393	16,485	- 22
ALB	AH	D	1,866	1,003	- 46
ALB	CN	I	10,867	4,919	- 54
ALB	CN	D	4,650	8,942	92
Subtotal			88,962	71,146	- 20
BIG	PR	I	868	1,631	87
BIG	PR	D	100	790	687
BIG	AH	I	2,354	2,376	0
Subtotal			3,323	4,798	44

SJK	PR	I	65,242	74,863	14
SJK	PR	D	15,832	27,664	74
SJK	AH	I	5,879	7,681	30
SJK	AH	D	20,072	44,742	122
SJK	CN	I	27,531	37,860	37
SJK	CN	D	47,393	48,067	1
Subtotal			181,951	240,878	32
YFN	PR	I	28,850	18,512	- 35
YFN	PR	D	22,028	21,248	- 3
YFN	AH	I	5,334	5,625	5
YFN	AH	D	11,209	19,412	73
YFN	CN	I	6,776	3,469	- 48
YFN	CN	D	67,840	56,598	- 16
Subtotal			142,039	124,764	- 12
Total			416,276	441,589	6

ALB = Albacore; BIG = Bigeye; SJK = Skipjack; YFN = Yellowfin
AH = American Samoa/Hawaii; CN = Continental; PR = Puerto Rico
D = Domestically-caught; I = Imports

MARINE MAMMAL BIOLOGY PROGRAM

Food Habits of California Sea Lions (Zalophus californianus)

A research project, using captive California sea lions located at Marineland of the Pacific in Palos Verdes, was recently completed by wildlife biologist Sandy Hawes to determine how accurately prey hard parts found in the scats of wild sea lions reflect the actual diet items.

The sea lions used for the experiment were two males and two females ranging from 65-150 pounds. The four animals were fed 2.5-5.0 pounds twice a day over a five day period of either anchovy (Engraulis mordax), jack mackerel (Trachurus symmetricus), or market squid (Loligo opalescens) per meal. All of the scat produced by the four animals was collected for the five feeding days as well as for six subsequent days. Samples were collected during the subsequent days in order to determine if prey hard parts are retained for extended periods.

The scat samples collected from this experiment have now been sorted and the prey hard parts removed. Identification and enumeration of the material is currently underway.

MARINE MAMMAL STOCK ASSESSMENT PROGRAM

Progress Continues on North Pacific Albacore Model

A version of the north Pacific albacore model was implemented on a new 16-bit microcomputer by fishery biologist Pierre Kleiber. This version of the model assumes a fixed seasonal pattern of albacore recruitment, growth, mortality, migration, and catchability. It therefore cannot account for the possible effects of environmental fluctuations such as "El Niño".

A workshop was held at the SWFC in mid-December to begin the process of incorporating environmental inputs into the albacore model. After reviewing the state of current research on the effects of the environment on albacore, the partici ants constructed a table showing the environmental variables that were thought to be potentially important. These include temperature, wind, upwelling, ocean currents, oxygen, and ocean fronts. The features of albacore life history and albacore fishery that might be affected by each of the environmental variables were indicated, and the persons conducting research on many of the environment/albacore effects were identified.

Panels Review Dolphin Abundance and Work on Kill Estimation

On December 6-9 a panel of experts met at the SWFC to review and assess investigations completed on the abundance of dolphin associated with tuna purse seine fishing in the eastern tropical Pacific Ocean (ETP). This meeting was part of a series of panel meetings, bringing in outside experts to review research results, preliminary to a comprehensive status of ETP porpoise stocks determination in 1984. Members of the panel were: Mr. G. Broadhead, Living Marine Resources, Dr. K. Burnham, North Carolina State University, Dr. Douglas Chapman, University of Washington and Marine Mammal Commission, Mr. John Cologne, NMFS, Dr. Andrew Dizon, NMFS, pre-SOPS Coordinator, Dr. Phil Hammond, IATTC, Dr. Roger Hewitt, NMFS, Dr. Rennie Holt, NMFS, and Dr. Tom Polacheck, NMFS. Dr. Wesley Parks chaired the meeting. The panel members reviewed the following documents: "Observer effects in shipboard sighting surveys of abundance" authored by John Cologne and Rennie Holt, "Reaction of dolphins to a survey vessel" authored by Roger Hewitt, "Density of dolphin schools in the ETP utilizing research platforms" by Rennie Holt, "Testing the validity of line transect theory to estimate density of dolphin schools" authored by Rennie Holt, "The effects of various sighting factors on estimates of sizes of dolphin schools in the ETP" by Wesley Parks, and "The distribution of sighting efforts by tuna purse seiners in the ETP" by Tom Polacheck.

On December 15-16 another panel met to review completed investigations on dolphin mortality, incidental to purse seining. Papers reviewed at the meeting were: "Incidental mortality of dolphins killed in the ETP 1959 to 1972" authored by Nancy Lo and Tim Smith; "Observer effect on incidental dolphin mortality in the ETP tuna fishery" authored by Bruce Wahlen and Tim Smith; "Reevaluation of the numbers of dolphins killed by purse seiners in the ETP between 1973 and 1978" by Bruce Wahlen, and "Rates of encirclement and

capture of dolphins by the U.S. purse seine fleet in the ETP" by Wesley Parks. The meeting was chaired by Dr. Tim Smith of the Oceanic Division. Panel members included: Mr. Frank Alverson, Living Marine Resources, Dr. Douglas Chapman, University of Washington and Marine Mammal Commission, Dr. Andrew Dizon, NMFS pre-SOPS Coordinator, Dr. Phil Hammond, IATTC, Dr. Nancy Lo, NMFS, Dr. Wesley Parks, NMFS, Mr. Bruce Wahlen, NMFS, and Dr. Kao-Tai Tsai, IATTC.

Reports have been prepared on the findings of the two panels and will be distributed.

PACIFIC ENVIRONMENTAL GROUP

Cooperative Study of Subsurface Climatology of Peru Current Yields Insights into Environmental Processes Affecting Fish Abundance

With PEG oceanographer David Husby, Dr. Fernando Robles, recently of the Catholic University of Talcahuano, Chile and presently with the Intergovernmental Oceanographic Commission in Paris, has been involved in a study of the subsurface climatology of the region of ocean off the west coast of South America. This region contains an assemblage of pelagic fish stocks very similar to that off the west coast of the United States. The purpose of the cooperative work conducted by Husby and Robles is to attempt generalizations that will provide insights into the environmental processes affecting the abundance of fish stocks in both regions.

During the week of December 5, Dr. Robles visited PEG to discuss the progress of their joint research with Mr. Husby. They are assembling available hydrographic and bathythermographic data to describe the seasonal and geographical variations of subsurface density structure and geostrophic current flow which are characteristics of El Niño and of non-El Niño conditions. Plans for subsequent research at PEG will compare these variations with seasonal and geographical aspects of life cycle strategies of fish species inhabiting the respective regions in order to identify those features which may have sufficient influence on survival to determine the evolution of these strategies. The features which have been identified would then be considered as strong candidates for incorporation as environmental components in fish population models designed to assist in fishery management.

One interesting finding of this study which is relevant to fishery research in the California Current is that many California Current fishes avoid those areas when spawning where their pelagic eggs and larvae may be subject to offshore transport and dispersion. The anchoveta population off north-central Peru, however, which has in the past been the world's most productive fishery stock, actually spawns at the season when offshore-directed surface transport is the strongest, in apparent nonconformity to the pattern observed elsewhere.

Mixed layer depth climatologies constructed by Mr. Husby have clarified the situation, indicating that the depth-averaged velocity of the mixed layer is less (by a factor of nearly four) during the period of maximum transport than during the period minimum transport. The indication is that in either region, fishery biologists should focus on the average offshore velocity of the mixed layer as the pertinent transport factor rather than the total offshore (Ekman) transport. Mr. Husby believes that insights of this type are helpful in selecting the proper formulation of environmental variables for incorporation in empirical modeling efforts.

Albacore Fishery Wind Logs Evaluated for Identification of Inhibition of Fishing Activities by Weather Conditions

Oceanographer Paul Sund has completed an evaluation of wind logs submitted by the albacore fleet. The purpose is to determine the weather conditions under which the ability to conduct fishing operations is substantially affected, in order to establish a basis for investigating interyear variability in fishing conditions. Such variations would affect the interpretation of catch data in attempts to provide estimates of variations in stock size.

The logged wind conditions were found to be not demonstrably different in distribution from the total population of winds logged from merchant vessels; thus, the effect on fishing operation is not well defined from this particular source. The reason may be in the very coarse categories in the albacore fishery logs, and in the fact that estimates of "daily-average" wind speeds are recorded rather than the more usual method of synoptic reports. Details of the evaluation can be found in a summary paper by Sund which will be distributed as an Administrative Report.

The investigation will continue using data resources available through PEG's collocation with Fleet Numerical Oceanography Center, and perhaps surveys of subjective estimates provided by experienced fishermen, to provide this particular component of information for SWFC albacore fishery modeling efforts.

TIBURON LABORATORY

UNDERUTILIZED FISHERIES RESOURCES INVESTIGATIONS

Experimental Fishing Cruise Yields Information on Several Species

Task leader Sus Kato and fishery biologist Sennen Salapare of the Underutilized Fisheries Resources Development Task embarked on an experimental fishing cruise aboard the NOAA Ship, David Starr Jordan December 12-20. The objectives of the cruise were to learn if tanner crab and spot prawn could be caught in commercial quantities with traps, and to test availability of blackgill rockfish, ocean whitefish, and sablefish. An additional objective of the cruise was to monitor and repair two fish aggregating devices (FAD's) deployed by the Jordan several months ago.

Fifteen strings of traps, each with 5 to 10 traps, were set at Santa Lucia Bank, at Point Arguello, and near Point Conception. Two strings of 8 traps were also set at 60-Mile Bank near San Diego. Catches of tanner crab and spot prawn were low. Sablefish, on the other hand, was abundant, with 19 fish traps producing 51 sablefish weighing 200 pounds. Carcasses of 20 more sablefish, eaten by "sand fleas" (probably mysids), were found in the traps. A pleasant surprise was the catch of eight octopus in a string of 10 traps set in 175 fm. Kato and Salapare plan to investigate this resource further during the next experimental fishing cruise in May.

Other species caught included a few blackgill rockfish as well as several other species of rockfish, many hagfish and sea urchins, box crabs, and two red rock crabs (notable because they were found in depths of 87 and 138 fathoms, whereas their normal habitat is under 20 fathoms. In addition, about 40 small whelks (Family Neptuneidae, probably Colus sp.) were caught in traps set in deep water. These whelks were delicious when boiled in sea water, as attested to by nearly all in the ship's crew and scientific party, which included three students from UC Santa Barbara: Lisa Dean, Craig Hall, and Kirk Henning.

Hook-and-line fishing at 60-Mile Bank produced 33 ocean whitefish (68 lbs) ranging from 36 to 53 cm. The fish were quickly bled, cleaned, and frozen. They will be given to two exporters who will ship them to Japan for market tests.

The missing attracting device for the FAD at 60-Mile Bank was replaced. An extensive search for the FAD placed at the 43-fathom spot was fruitless; that FAD has been lost, for unknown reasons.

Sea Grant Advisors Meet; Plan Herring Workshop

At the quarterly meeting of the Bay Area Sea Grant Advisors at Fort Mason, San Francisco, plans were made to hold a herring workshop to be jointly sponsored by Sea Grant, the city of Sausalito, and local fishermen. The workshop is scheduled for Saturday, February 18, at the Army Corps of Engineers facilities in Sausalito. Economist Ed Ueber will moderate one of the two panels. Population dynamacist Donald R. Gunderson of the University of Washington will participate, and will meet with Ueber before the workshop.

Tiburon Laboratory Staff Meeting of NMFS West Coast Economists

NMFS West Coast economists held their second quarterly meeting of FY 84 at the Tiburon Laboratory on December 7-9. Economist Ed Ueber chaired the meeting which was attended by all the economsits of the Southwest Center and the Southwest Region, and senior economists of the Northwest and Alaska Fisheries Center. Discussions covered past, present, and proposed economic research for all areas of the West Coast, Hawaii, Alaska, and the Pacific Islands. Dr. Dan Huppert and Dr. Richard Marasco reported on the national NMFS economists' meeting. (See also an account of this meeting under the submission for the Coastal Fisheries Resources Division, Commercial and Recreational Fisheries Research for Management, page 8).

FISH COMMUNITIES INVESTIGATIONS

Impact of Early Winter Storms Noted in Northern California Nearshore Communities

The nearshore marine communities of northern California have been strongly affected by the severe early winter storms that have battered the coast during the past 2 months. This was the observation of investigation leader Dr. Edmund Hobson and fishery biologists Tony Chess and Dan Howard at their study sites on the Mendocino coast this month. The beds of bull kelp *Nereocystis luetkeana* that were unusually dense and widespread this year are now limited to a relatively few places sheltered from the seas, and even here more than half of the plants have been carried away. Among the fishes, no current year-class rockfishes (*Sebastes* spp.) were seen. Although the rockfish species that usually dominate as juveniles in this area (i.e., *S. melanops*, *S. mystinus*, and *S. flavidus*) were relatively sparse this year, juveniles of *S. caurinus* were usually abundant (see Monthly Reports for July and August) until this month. In past years, young-of-the-year rockfishes have remained abundant in this area throughout the period of winter storms. Significantly, the most numerous fish in the area at this time were young-of-the-year senoritas, *Oxyjulis californica*, a southern California labrid only occasionally seen in northern California. Thus some features related to the uncharacteristically high water temperature of last summer have persisted

through the first winter storms, even though temperatures now are near normal for this time of year.

Seasonal Development of Rockfish Larvae Monitored

The appearance of eyed larvae in the gonads of Sebastes spp. is being used by fishery biologist Tina Echeverria to monitor variations in seasonal development of the various species of Sebastes. This information provides a means to estimate when the larvae will be extruded, and which species are most likely to be captured during the survey with a midwater trawl in June. Current sampling at Bodega Bay has shown that larvae of S. paucispinus and S. goodei are developing on a schedule consistent with previous years, but those of S. flavidus are behind schedule.

PHYSIOLOGICAL ECOLOGY INVESTIGATION

Study of Richardson Bay Fish Community Completed

Fisheries biologists Mickey Eldridge, Roger Green, and Paul Wares have completed a manuscript on the juvenile and adult fish community of Richardson Bay, California. The fish populations of this small bay (approximately 16 hm^2) were sampled in a stratified random sampling design with gill nets and trawls for more than a year. The site was selected because of its similarity to the San Francisco Bay/Delta estuary in geology, hydrology, bathymetry, historical development, and urbanization.

The environment, the fish community, and their interrelationships were studied with the help of multivariate and univariate statistics. The environment of Richardson Bay was seasonally affected by precipitation, waste water discharges, and the proximity to marine waters near the entrance of San Francisco Bay. The causal patterns related well to those currently being found in San Francisco Bay. The fish community can be characterized in a number of ways. The major species taken in this study and in a related ichthyoplankton study were planktivores, hervibores, or low-level carnivores. They represented Embiotocidae, Atherinidae, Pleuronectidae, Clupeidae, Engraulidae and Gobiidae. An exception was the piscivorous striped bass which is an introduced species. The fish fauna were mostly marine coastal species (31), with 5 euryhaline-marine species and 4 anadromous species. This survey conformed with other estuarine studies in that 5 or fewer species comprised more than 80% of the total catch, and the number of species and their abundance increased between spring and fall. Temporal/spatial distributions and abundance of fishes could be closely related to temperature and salinity throughout the Bay. These, in turn, were found to be dependent on fresh water inflow, the degree of flushing, and conditions in the coastal marine waters.

This study demonstrated how the structure and organization of fish communities are the result of the dynamic interactions of the communities and their environments. These results will be especially useful to resource

managers because both Richardson Bay and San Francisco Bay are experiencing significant changes due to water-related developments and increased urbanization.

FISHERIES INFORMATION SYSTEMS AND AUTOMATIC DATA PROCESSING

CALFIN Update

Groundfish "Credit Card" System Reviewed

Izadore Barrett, John Carr, Fred Kellenberger and David Mackett met with Dick Heimann, Eric Knaggs, Jim Hardwick and Ken Oda in Monterey on December 20, 1983 to review the groundfish "credit card" system. The system was originally implemented in November 1983 by the Southwest Fisheries Center (SWFC) and California Department of Fish and Game (CDF&G) to collect and process fishery landings data. The system which has improved the accuracy of collection of fishery data by 40%, will be modified to take into account the new requirements that were discussed in Monterey. The group also had some very informative discussions with the Reigal Fisheries Inc., at Moss Landings, California and Monterey, California, on the collection of fishery landings data. The fishery companies recommended some improvements to the system.

WPACFIN

Improvement Made in WPACFIN System

David C. Hamm, Computer Systems Analyst at the Honolulu Laboratory, traveled to Guam and Saipan this month to work with personnel in the Guam Division of Aquatic and Wildlife Resources (DAWR) and the Saipan Division of Fish and Wildlife (DFW). Hamm further refined the first major software module of the offshore survey expansion system by obtaining user input on the system report formats developed to date. The DFW personnel will be testing the new software system in preparation for using it to analyze and expand FY 1983 fisheries data. The DAWR personnel are preparing to implement creel surveys based on the design supported by the software system.

While at DAWR, Hamm trained the new Aquatic Resources Branch Chief and the new computer operator on use of the WPACFIN microcomputer hardware and software. He also had several meetings with representatives from DAWR, the Guam Department of Commerce, the Guam Fishermen's Coop, and Pacific Data Systems to discuss various data collecting and processing activities being conducted via Honolulu Laboratory, WPACFIN, and Western Pacific Regional Fishery Management Council contracts. Areas of responsibility and interaction were clarified and several improvements to methodologies were identified.

At DFW, the staff concentrated on analysis of current resources and data to develop procedures for implementation of creel surveys similar to those being conducted in Guam. Improvements for conducting the participation survey were identified and a data base was developed to store and analyze the data. Hamm and DFW personnel developed data collection instruments, codes, strategies, and priorities for fielding the creel surveys. In addition, a data base system was established for storing, summarizing, and reporting data collected on the Tinian tuna transshipment operations.

ADP Activities

Center Staff Undertakes WORDSTAR Training

The SWFC has recently evaluated several word processing software packages for use by the scientific and secretarial staff, and has decided to use the software package WORDSTAR. This month Susan Iacometti began instructing the secretarial staff at the La Jolla Laboratory in the use of WORDSTAR. During December, Iacometti conducted two Phase I classes on WORDSTAR, 3 days of 2-hour sessions. Members of the Director's Office staff and the secretarial staff from the Coastal Division participated in one class. Five staff members from the Southwest Region Office in San Diego attended the other class. At the end of the instruction period, the participants were able to type in and print letters and documents. To those attendees who had submitted their final homework assignments, Iacometti awarded WORDSTAR course completion certificates.

Inventory of Major ADP Equipment Completed

The ADP group at the SWFC has gradually been buying major ADP equipment, including several multi-user super-microcomputers, since 1981 to increase the staff's capability to process and analyze data. This month, Dorothy Roll, Computer Systems Analyst, completed the inventory of equipment and estimated the cost of the microsystems purchased from 1981 through 1983 for the SWFC's laboratories. Roll's preliminary report showed that $575,000 has been expended for the procurement of 3 Molecular Supermicros 32X, 1 Molecular Supermicro 15-8, 23 La Jolla Standard CP/M based (single user) microcomputers, 5 La Jolla Standard MP/M (multi-user) microcomputers, 12 non-La Jolla Standard microcomputers, 3 8-16 bit scientific processor units, and the associated peripherals for these microsystems. The peripherals include CRT terminals, letter quality and dot-matrix printers, models for communication, and error controller boxes. The report has been submitted to the Director's office for approval and distribution to the Laboratory Directors and Division Chiefs.

Committee Discusses Plans for Data Management

The La Jolla Laboratory Data Management Committee met on December 13. Attendees were Fred Kellenberger, Jack Brown, Robert Nydam, Dorothy Roll, Susan Iacometti, ADP, Rich Charter, CFRD, and Al Coan, OFRD; they discussed the implementation plan for the super-microcomputers at the La Jolla Laboratory and the David Starr Jordan. Other topics discussed were the time schedule for implementing the Financial Reporting System (FRS) and WORDSTAR, the maintenance plan and procedures for the super-microcomputers and the La Jolla Standard microcomputers, and the interface of the CAMAC (data collection device) to the shipboard 15-8 super-microcomputer. With the assistance of a student assistant, Jack Brown will maintain all computer hardware at the La Jolla Laboratory and the Jordan. February is the target date for implementing FRS on the 32X super-microcomputer; March is the target date for WORDSTAR. A recommendation was made for the establishment of a Jordan committee to

coordinate and plan the shipboard hardware and software developments. Representatives from the Divisions and ADP will be members of this committee. The requirements of both the Tiburon Laboratory and the Pacific Environmental Group will also be considered by this Committee.

MISCELLANEOUS

HONORS AND AWARDS

La Jolla Laboratory

Director Izadore Barrett presented awards to the following staff members during ceremonies in the Center auditorium on December 12, 1984:

Frances Begley, Secretary, Helen Becker, Editorial Assistant, Cheryl Harless and Patricia Metcalf, Clerk Typists - Group Special Service Award; Gary Hunt, Biological Aid - Special Act or Service; Wesley Parks, Fishery Biologist - Special Act or Service; Ben Remington, Executive Officer - Cash Award in connection with his being selected as the Outstanding NMFS Employee of the Year in 1982 (Management Category); Laura Wing, Clerk - Special Act or Service.

Shown below receiving their citations from Director Barrett are:

Frances Begley

Benjamin Remington

Patricia Metcalf

Helen Becker

Wesley Parks

SEMINARS

La Jolla Laboratory

Under the Chairmanship of Dr. David Au, the following seminars were presented at the La Jolla Laboratory in December:

December 6 - Dr. Ralph G. Appy, California State University, Long Beach discussed, "The use of parasites in information retrieval in marine environments."

12 - Dr. Ralph Schreiber, Natural History Museum, Los Angeles, California, spoke on, "El Niño according to the sea bird world."

16 - Dr. Jane Packard, U.S. Fish and Wildlife Service, Gainesville, Florida, talked on the subject, "Ecology, assessment and management of manatees in Florida."

PUBLIC AFFAIRS

The fourth annual "Day at the Docks", sponsored by the San Diego Sportfishing Council was held at Fisherman's Landing in San Diego on Sunday, December 4. The Southwest Fisheries Center was represented by a 3-part exhibit featuring the El Niño, yellowfin tuna development and billfish tagging. Fishery biologist Jim Squire and scientific illustrator Ken Raymond manned the Center's booth.

Representing the Southwest Region was home economist Doris Robinson who had a separate display with free samples of cooked fish products and recipes.

Squire and Raymond estimate that about 5,000 persons attended the 1-day event which also included displays from fish tackle manufacturers, and free rides on sport fishing boats, live entertainment, and a fishing area for children. Among the companies and agencies participating were Kelco, California Department of Fish and Game, University of California, San Diego, and National Marine Fisheries Service.

According to Squire and Raymond, the Center's exhibit was well received and drew many favorable comments and questions concerning the research shown.

* * * * * * * * * *

Jim Squire was the featured speaker at a meeting of the International Society for Correlative Biological Research held at the Scripps Institution of Oceanography on December 12. The subject of Squire's talk was the "El Niño period and its effects on coastal fisheries."

* * * * * * * * * *

Economist Dan Huppert discussed "Science and art in fisheries management: Implications of the Fishery Conservation and Management Act" for the Environmental and Natural Resources Policy Visiting Speaker Series sponsored by the Division of Environmental Studies, University of California at Davis, California, on December 6.

* * * * * * * * * *

Two fisheries scientists from the Southwest Fisheries Center presented expert testimony to the California Legislature Joint Subcommittee on Fisheries and Aquaculture, December 16, in San Diego. Dr. Alec MacCall presented testimony on stock assessment and on the northern anchovy while Dr. Reuben Lasker presented testimony on the status of scientific relationships with Mexico.

Tiburon Laboratory

Tiburon Laboratory Staff Excels in Community Commitment

One of the public services the Tiburon Laboratory provides has not previously been reported--community commitment to emergency awareness and preparedness. The Tiburon Laboratory Blood Group donated over 50 pints of whole blood to the Veterans' Hospital in 1983. Chair and vice-chair Edward Euber and Nancy Wiley received, on behalf of the blood group, the highest possible award from the Irving Memorial Blood Bank. The Tiburon Laboratory has the greatest percentage of donors, of those able to give blood, in the Bay Area, and its donor-to-employee ratio is more than 50%, which is truly exceptional compared to the 5% average.

Another area of community service is the training of staff in first aid and cardiopulmonary resuscitation (CPR). In November and December, Paget Leh of the Southwest Region's Environmental Assessment Branch, with an assistant, certified 25 staff members in CPR. In December Ueber, with Leh's assistance, certified 11 staff members in Standard Multimedia First Aid.

Blood donations and emergency training serve the community 24 hours a day, 7 days a week, and help contribute to a safer and more aware staff.

VISITORS

Honolulu Laboratory

December 13 - Steve Williams, Queensland Department of Primary Industries, Brisbane, Australia.

14 - Roger Pflum, Yap Island, Federated States of Micronesia.

19 - Virginia Stout, Northwest and Alaska Fisheries Center.

La Jolla Laboratory

December 9 - Mr. Bob Fletcher, Deputy Director, California Department of Fish and Game, at the SWFC to attend a meeting on State/Federal affairs.

19 - Norma Yost, Special Assistant to Administrator John Byrne, Washington, DC.

27-29 - Dr. S.R. Goldberg, Biology Department, Whittier College, Whittier, California.

Pacific Environmental Group

December 1-2 - John Hayes, Director, NOAA Office of Oceanography and Marine Science.

5-9 - Dr. Fernando Robles, Intergovernmental Oceanographic Commission, Paris.

20-21 - Center Management Team: Izadore Barrett, John Carr, Rirchard Shomura, Reuben Lasker, Gary Sakagawa, Norm Abramson, David Mackett, Ben Remington, and Fred Kellenberger.

30 - Sister Juliana Lucy, Biology Department, San Jose State University.

Tiburon Laboratory

December 5 - Tyson Roberts, California Academy of Sciences.

9 - Dr. David L. Cutchin of UCSD/NORPAX to discuss Tiburon facility support for the Volunteer Observing Ship Program with Norman Abramson.

29 - Sister Juliana Lucy, San Jose State University, to discuss with Edmund Hobson and Director Norm Abramson a Sea Grant proposal to develop mathematical measures of oceanic conditions and relate them to the abundance of organisms in the Bering Sea.

MEETING AND TRAVEL

Honolulu Laboratory

December 5-7 - Dr. Robert A. Skillman attended the Pacific Fisheries Development Foundation Fisheries Officers Workshop at Kahi O Mahala, Honolulu.

9 - Dr. Skillman attended a tuna purse seine meeting arranged by Susumu Ono, Chairman, Department of Land and Natural Resources (DLNR), at the DLNR board room.

14 - Laboratory Director Richard S. Shomura attended the Pacific Sea Grant College Program Directors meeting at Camp Menucha, Oregon.

21-22 - Richard Shomura participated in the Center Management meeting in Monterey, California.

La Jolla Laboratory

December 5-9 - David Holts was at sea aboard the R/V Kelpbass to observe gill net dynamics.

6-9 - Dan Huppert traveled to Davis, California, to present a seminar at UC Davis; and to Tiburon, California, to attend a SWFC/SWR economist meeting.

7-9 - Sam Herrick and Cindy Thomson traveled to Tiburon, California, to attend a Center/Region economists meeting.

12-16 - Charles Oliver and Larry Hansen traveled to Long Beach, California, to conduct an aerial survey of pilot whales around Santa Catalina and San Clemente Islands.

15 - Mark Lowry traveled to San Clemente Island to conduct pinniped census, collect Zalophus scats for food habits study, and tag resights.

15-19 - Jeanne Wexler traveled to San Clemente Island to perform counts, tag resights and scat collections on sea lions.

18-22 - Fred Kellenberger traveled to Tiburon, California, to review the implementation of the super-microcomputer at the Tiburon Laboratory.

21-22 - A Center Management Meeting was held in Monterey. Attending were all members of top management at the Center, Director Barrett, Deputy Director Carr, Drs. Reuben Lasker and Gary Sakagawa, Division Chiefs, Fred Kellenberger, Data Systems Manager, Ben Remington, Executive Officer, Laboratory Directors Richard Shomura, Norm Abramson, Andy Bakun, and David Mackett, Planning Officer.

Pacific Environmental Group

December 5-7 - Doug McClain attended the fall annual meeting of the American Geophysical Union, and prepared a paper at a special sesison on the California El Niño of 1982-83.

19-21 - Dick Parrish traveled to La Jolla for a SWFC albacore research planning meeting.

Tiburon Laboratory

December 6 - Ed Ueber attended the Bay Area Sea Grant Advisors' meeting in San Francisco.

7-9 - Ed Ueber chaired the quarterly West Coast economists' meeting in Tiburon.

20-21 - Norman Abramson attended the Center Management meeting at the Pacific Environmental Group in Monterey.

27-29 - Ed Ueber attended the meeting of the American Economic Association in San Francisco.

PERSONNEL

Honolulu Laboratory-

December 1 - Scot H. Hamaguchi, Biological Aid (Fisheries) - Extension of Full-Time Temporary Appointment.

14 - Joan P. Draper, Computer Programmer - Part-Time Temporary Appointment.

19 - Heide Miller-Pakvasa, Computer Programmer - Part-Time Temporary Appointment.

23 - Miriam B. Pillos, Biological Science Student Trainee (NOAA Jr. Fellow) - Return to Duty.

24 - Scot H.Hamaguchi, Biological Aid (Fisheries) - Termination.

25 - Michael P. Seki, Biological Technician (Fisheries) - Promotion and Conversion to Full-Time Permanent Position.

28 - Theresa Villanueva, Biological Science Student Trainee (NOAA Jr. Fellow) - Return to Duty.

La Jolla Laboratory

December 1 - Louis Arnell, Biological Technician - Extension of Temporary Appointment.

2 - Harold Wordlaw, Cash and Attendance Clerk, Full-Time Temporary Appointment Entered on Duty.

- Gary Hunt, Biological Aid - Resignation.

6 - Roberta Folk, NOAA Jr. Fellow - Return to Duty.

8 - Laurie Patla, Biological Technician - Extension of Temporary Appointment.

- Lisa Lau, NOAA Jr. Fellow - Return to Duty.

9 - Owen Stiles, Cash and Attendance Clerk - Resignation.

- Cheryl Harless, Clerk-Typist - Resignation.

12 - Lisa Ankenbrandt, Computer Assistant - Extension of Temporary Appointment.

- John Michno, NOAA Jr. Fellow - Return to Duty.

14 - Eugene Sibbald, Computer Systems Programmer - Redescription of Duties.

- Christina Show, Computer Systems Programmer - Redescription of Duties.

- Tony Majors, Fishery Biologist - Redescription of Duties.

- Al Jackson, Biological Technician (Fisheries) - Redescription of Duties.

- Tod Foster, Fishery Biologist - Redescription of Duties.

- Atilio Coan, Supervisory Math Statistician - Redescription of Duties.

- Peggy Cheng, Computer Assistant - Redescription of Duties.

- Ken Wallace, Computer Programmer Analyst - Redescription of Duties.

- Jay Walker, Computer Systems Programmer - Redescription of Duties.

- Lily Tang, Computer Assistant - Redescription of Duties.

- Tom Tumosa, Biological Technician (Fisheries) - Redescription of Duties.

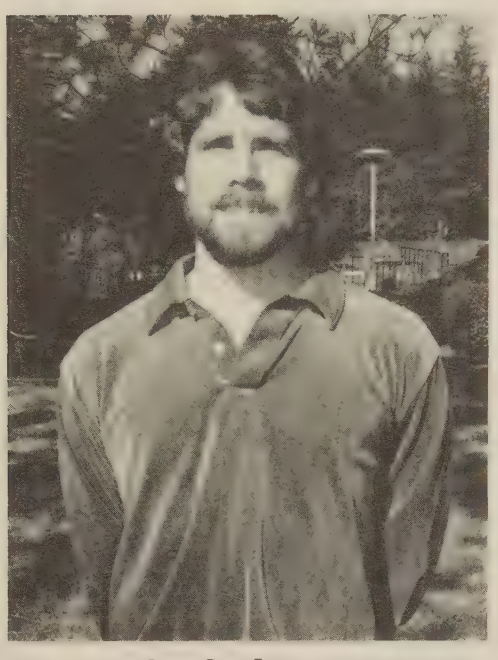
16 - Amy Kimball, NOAA Jr. Fellow - Return to Duty.

20 - Susan Chivers, Computer Assistant - Extension of Temporary Appointment.

27 - Beverly Macewicz, Biological Technician - Entered on Duty, Part-Time Permanent.

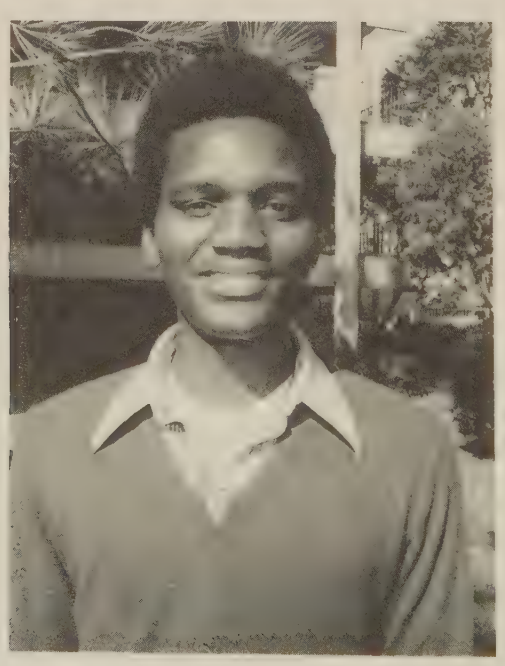
27 - Richard Winn, Accounting Technician - Transfer to EASC.

Show below are additions to the staff of the La Jolla Laboratory:



Jay Barlow
Operations Research Analyst
EOD: December 2, 1981

Lorna Marquez
Budget and Accounting Technician
EOD: November 14, 1983



Harold Wordlaw
Cash and Attendance Clerk
EOD: December 2, 1983

Tiburon Laboratory

December 1 - Katherine A. Payne, Clerk-Typist - Resignation.

- John C. Greeley, Editorial Assistant - Temporary Appointment.

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